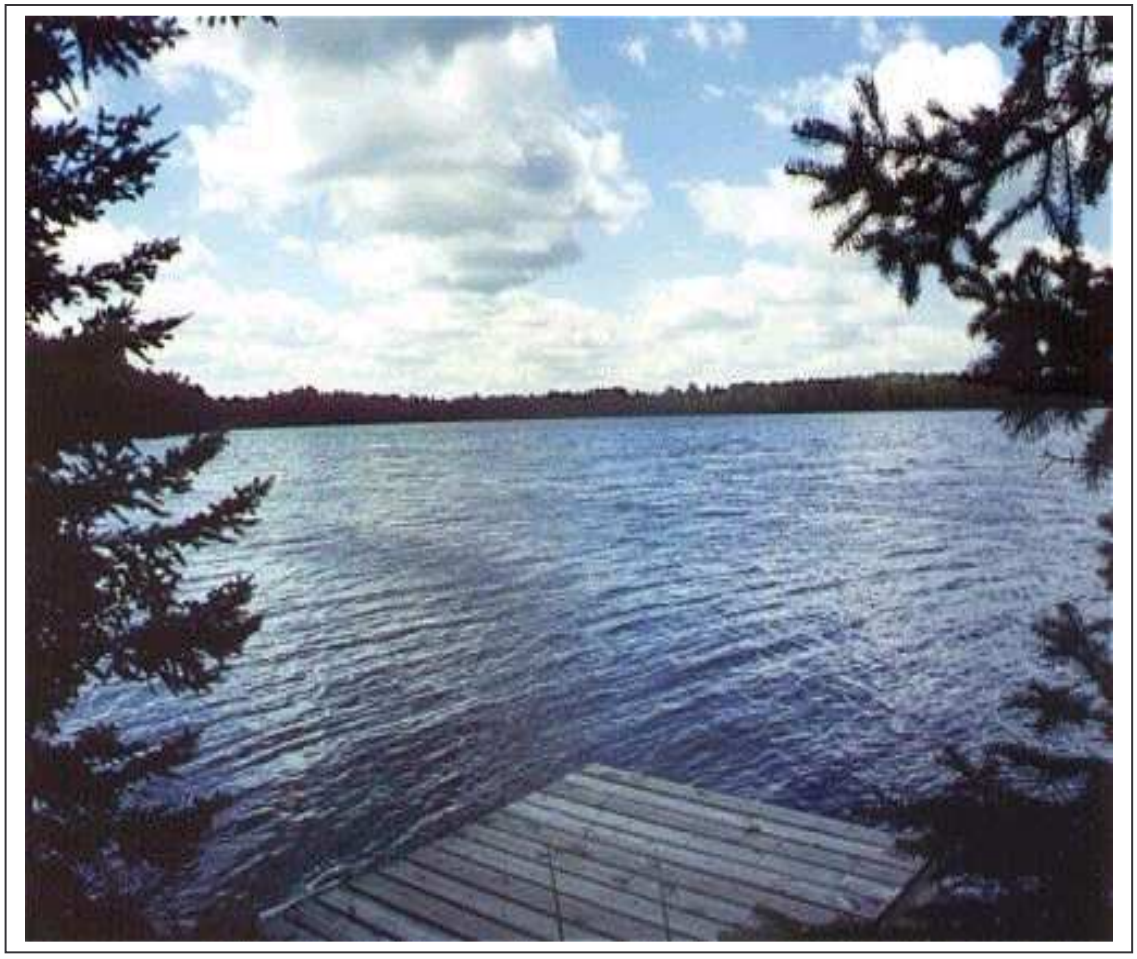

TRI-LAKES MANAGEMENT PLAN

Updated 2007

Tri-Lakes Management Plan Advisory Group

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TRI-LAKES MANAGEMENT PLAN

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INTRODUCTION

Chapter 92 of the Wisconsin State Statutes established the Adams County Land and Water Conservation Committee (LWCC) and the Adams County Land and Water Conservation Department (LWCD). The LWCC and LWCD have the responsibility of conserving long-term soil productivity, protecting the quality of related natural resources, enhancing water quality and focusing on severe soil erosion problems.

The Tri-Lakes Management District was formed in 1978 to monitor lake water quality and implement best management practices to maintain and improve lake water quality and quantity on Arrowhead Lake, Sherwood Lake, and Camelot Lake (Tri-Lakes).

The Wisconsin Department of Natural Resources (WDNR) is dedicated to the preservation, protection, effective management, and maintenance of Wisconsin's natural resources. It is responsible for implementing the laws of the state and where applicable, the laws of the federal government that protect and enhance the natural resources of our state.

To achieve the purposes of the Tri-Lakes Management District, Adams LWCC/LWCD, WDNR and to address increased natural resources concerns due to increasing development within the Tri-Lakes area, a Tri-Lakes Management Plan was developed. The plan addresses natural resource issues on the lakes and also in their watersheds. The plan is dynamic and revisions will occur annually to reflect current events and priorities. The Tri-Lakes Management District will receive public input on plan revisions at the Tri-Lakes Management District Annual Fall Meeting. The Tri-Lakes Management District will notify all members of the district and will accept written comments from the members and the public who cannot attend. The plan will utilize best management practices, education, and regulations to improve the natural resources. The plan will incorporate human conveniences in a manner that does not compromise the quality and quantity of the natural resources.

All ordinances, policies, and activities associated with the State, County, and Town must receive approval from proper authorities. The plan consists of goals and action items to address natural resource issues and activities for a five-year period. As one year passes, another year of the plan will be added so the plan will always reflect a five-year period. Scientific studies, community residents, and the general public were inventoried to determine the goals of the plan. A Lake Advisory Group (LAG) was formed to identify action items, write the rough draft of the Lake Management Plan, and in the future assist Tri-Lakes Management District with updates and revisions. The LAG consists of WDNR specialists, Tri-Lakes Management board, community businesses, community residents, and Adams LWCD. Once the rough draft was written, LAG members disseminated the plan and received feedback. There were also two public meetings held to receive feedback. LAG members met after receiving the feedback and incorporated the feedback as allowable and deemed necessary into the Tri-Lakes Management Plan. The Tri-Lakes Management Board is responsible for implementing and updating/revising the Tri-Lakes Management Plan. The Tri-Lakes Management Board consists of a representative

from each Lake Association, the Town of Rome, and the Adams County Board. Copies of the Tri-Lakes Management plan have been distributed and are available at the following locations: Tri-Lakes Management District; Arrowhead Lake Association; Sherwood Lake Association; Camelot Lake Association; Town of Rome; Rome Public Library; WDNR Service Center in Wisconsin Rapids; Adams Public Library; and Adams Land and Water Conservation Department.

TRI-LAKES CHARACTERISTICS

There are 4 County owned dams in Northern Adams County located on 14 Mile Creek creating 3 separate lakes called Tri-Lakes. The Tri-Lakes are Sherwood Lake, established in 1967, Camelot Lake, established in 1969, and Arrowhead Lake established in 1978. The Tri-Lakes are part of the 14 Mile Creek Watershed. Waters from Tri-Lakes drain into the Petenwell Lake which WDNR has listed as an impaired water body 303(d)(1)(C), Clean Water Act. In 1993, the Tri-Lakes and Watershed Characterization report stated the following: North Camelot has a surface area of 191 acres with a maximum depth of 23 feet and an average depth of 10 feet; South Camelot has a surface area of 260 acres with a maximum depth of 23 feet and an average depth of 10 feet; Sherwood has a surface area of 250 acres with a maximum depth of 26 feet and an average depth of 10 feet; Arrowhead has a surface area of 295 acres with a maximum depth of 27 feet and an average depth of 12 feet. The Tri-Lakes Management District governs Lake activities. A public sanitary sewer does not service this area. Studies have been conducted on the lakes and the watershed to identify water quality issues.

The Adams County Land and Water Conservation Department oversees the operation, maintenance, and inspection of the dams. There is currently an Emergency Action Plan in place that dictates actions to be taken when an emergency event occurs.

The climate in this region is classified in the continental climate type. Fall and spring have variable weather conditions usually accompanied by winds. The summers are warm with occasional periods of high temperatures and humidity. Winters are usually cold, and snowy. In an average winter, snow cover on the ground and ice cover on the lakes lasts from December to April. The growing season generally extends from late May to early September, for an average frost-free growing season of 135 days. Mean annual precipitation is almost 30 inches of which 60% occurs during June to September. Winds come out of the northwest from late fall through spring, and from the South during the remainder of the year. The wind speed generally ranges from 4 to 15 miles per hour with periods of stronger winds occurring in spring and fall.

The major soils in the Tri-Lakes Watershed are sands and loamy sands on nearly level to gently sloping outwash plains and knolls. Water and air move rapidly through the soils and runoff is slow. The soils are suitable for wood production, irrigated crops, pastures, and building sites. The soils are suited for septic tank absorption fields but there is a danger polluting the groundwater due to the rapid permeability of the soils. Sand and loamy sand soils are subject to wind erosion when they are cultivated. The soils are unsuitable for onsite waste disposal because of seepage. Areas of muck and poorly drained loamy sands are found in depressions and drainage ways scattered throughout the area. Water and air move through these soils at a moderate rate and runoff is slow or ponded. These soils are best suited for wetlands,

and pastures. Crops may be grown if drainage occurs. The muck and poorly drained sandy loams soils are poorly suited for building sites, septic tank adsorption fields and onsite waste disposal. (Soil Survey of Adams County, 1984)

The Tri-Lakes Watershed consists of 62, 035 acres (Tri-Lakes and Watershed Characteristics, 1993). Land use of the watershed in 1800's was 75% woodlands, 20% wetlands and 5% grasslands. Land use reported in 1993 was forest 31%, agriculture 50%, residential 8%, conservance 1%, and pasture 10% (Tri-Lakes and Watershed Characteristics, 1993). Current land use in the watershed is approximately 30% woodlands, 20% cropland, 15% water, 20% grasslands, wetlands 10% and other 5%. (Enterprise Information, 1998).

The majority of the cropland is located in the east half of the watershed and is irrigated with center pivot or hand line sprinklers. The main crops grown include vegetables for processing, potatoes, and cranberries. Wind erosion on cultivated fields is a major concern due to sandy soils. Cropland without adequate plant cover or crop residues erode during strong wind events.

The Central Sands Wind Erosion Control Pilot Project was initiated in 1988. The project was supported and advised by Golden Sands Resource Conservation and Development, the Land and Water Conservation Departments in Adams, Portage, Juneau, Wood and Waushara counties, The Wisconsin Potato and Vegetable Growers Association, area Townships, Department of Agriculture, Trade and Consumer Protection and University of Wisconsin – Extension. The goal of the project was to reduce wind erosion in the Central Sands Area by offering property tax credits for landowners who installed wind erosion control practices, conduct conservation tillage demonstrations, and inform and educate people on causes and solutions of wind erosion. (Central Sands Wind Erosion Control Project, 1991) The project transformed to become the Central Wisconsin Windshed Partnership(CWWP), supported by the same groups as mentioned before. The CWWP presently provides tree planting services, conducts conservation tillage demonstrations, and educates people about best management practices on sandy soils.

Between 1990 and 1992, a study to determine the impact of wind erosion on water quality was completed. The study determined wind eroded soils from croplands contain solids, phosphorus, nitrogen, and pesticides. The wind is depositing the soil in the streams, which significantly impacts water quality in the watershed. The study recommended the use of best management practices such as conservation tillage, cover crops, buffers, crop residues, nutrient management plans, irrigation management plans and pest management plans. Currently, Central Wisconsin Windshed Partnership, Golden Sands Resource Conservation and Development, Wisconsin Department of Natural Resources (DNR), USDA-Natural Resource Conservation Service, Adams Drainage Board, University of Wisconsin – Extension and Department of Agriculture, Trade, and Consumer Protection are providing education, plan and design assistance and financial programs to crop, livestock, fruit, and wood producers. (Wind Erosion Impacts on Water Quality in the Sand Plain of Central Wisconsin, 1993)

The Leola Drainage District and the Portage Drainage District are located in the upper watershed. The drainage has occurred since the early 1900's to allow crop production on normally wet soils. The Adams County Drainage Board currently maintains the ditches and is working with landowners to install best management practices. Chapter 48 of the Wisconsin Statutes provides rules and policy for drainage districts.

The predominant land use in the lower watershed is woodlands. A large majority of the woodland is owned by lumber companies and is managed to harvest the timber. Also existing in the lower watershed is residential land use concentrated in the Tri-Lakes area and along Fourteen Mile Creek between Arrowhead Lake and Petenwell Lake. In 1978, the number of parcels located in the Tri-Lakes area was 3,828 with only 934 of the lots having a house. A survey conducted in 1978 estimated that approximately 280 of the houses contained permanent residents.

It was reported in 1999 that 387 out of 865 properties in the Sherwood Lake area were developed. Development has typically occurred within 75 to 100 feet of the water's edge and the lots are generally 75 foot in width. (Septic System Evaluation, 1999) Currently, the Tri-Lakes Management District (area around the Tri-Lakes) has 4,892 lots and most of these lots have a house on them. It is estimated that 1,077 of these houses contain permanent residents.

There are 5 named streams and ditches and 27 unnamed ditches totaling 349 miles in the 14 Mile Creek watershed. Chester Creek has been designated by the Wisconsin Department of Natural Resources (WDNR) as a Class I trout stream and Exceptional Resource Water. Ditch No. 7 is a tributary of 14 Mile Creek. WDNR has reported Ditch No. 7 as a cold-water fishery that needs further surveys to determine the streams potential use. Channel ditching, nutrient and sediment loading, shallow channel depth and lack of fish cover impact the stream. The 14 Mile Creek is classified by WDNR as a warm water game fishery with limited in-stream fish habitat. Factors limiting fish habitat are streambank erosion, shallow channel depth, sedimentation, and lack of pools, riffles, and fish cover. WDNR has classified Leola Ditch as a warm water fishery with the potential to be a cold water fishery in the upper reaches. Dredging, sedimentation, lack of pools, and lack of fish habitat impact the stream. Stream surveys show organic loading to the stream and 1999 water quality sampling found nitrate levels above 5 ppm. Unnamed Ditch 13-13 is a tributary to Leola Ditch and WDNR has classified it as a warm water fishery. Cranberry operations may discharge waters to the stream. Stream impacts are channel ditching, sedimentation, nutrification, flow fluctuations, lack of pools, riffles, and habitat, and organic loading. Unnamed Ditch 12-1 is a tributary to 14 Mile Creek and WDNR has classified it as a warm water forage fishery. Cranberry operations may discharge waters to the stream. Stream impacts are channel ditching, sedimentation, flow fluctuations, lack of pools, riffles, and habitat. Spring Branch is a tributary to Camelot Lake and WDNR has classified it as a warm water forage fishery. (The State of the Central Wisconsin River Basin – DNR, 2003).

Groundwater generally flows east to west towards the Wisconsin River. In 1971, it was reported that groundwater supplies are sufficient enough as to supply adequate amounts of water for both the public and private domestic users as well as upper watershed irrigation users (Effects of Irrigation on Streamflow in the Central Sand Plain of Wisconsin, 1971). The groundwater is moderately hard and has localized problems of high dissolved iron content.

Regional water table elevations vary between 940 – 970 sea level datum (Water Management Plan Fourteen Mile Creek Watershed, 1979)

Rome Water Utility is the only municipal water supply system in the watershed. Two wells are operated to serve the residents of the Lake Camelot Property Owners Association. The wells are productive and operated below their yield potential because one of the wells has nitrate concentration exceeding 15 ppm which exceeds the maximum contaminant level of 10 ppm. The other well has 4 ppm nitrate so the utility blends the water from each well to reach an acceptable level. The utility has attempted to reduce the nitrates by working with area agricultural producers and by purchasing land up gradient from the wells and taking it out of production. This action did not reduce the nitrates so the utility has drilled a new well in a protective area of woodlands. A wellhead protection program is required for the new well. WDNR suggests a well head protection program be developed for the existing wells (The State of the Central Wisconsin River Basin–DNR, 2003).

HISTORY AND RESULTS OF TRI-LAKES STUDIES

Lake Management Plan, 2004

In March 2004, the Adams County Land and Water Conservation Department conducted an inventory of Tri-Lakes Property Owners to identify issues important to them and rank the issues in order of importance. The Tri-Lakes Management District provided assistance and guidance during the inventory process. The information was used to develop goals and action items for the Tri-Lakes Management Plan. Invitations were sent to every member of the Tri-Lakes Management District, which totaled over 4,000 mailings. On the front of the invitations, was information regarding meeting times, places, and Land and Water Conservation mailing and e-mail addresses. On the back of the invitations, the question "What are the most important issues regarding the lakes and watershed and list them in order of importance. By providing this information on the invitations, it gave residents who could not attend the meeting an opportunity to respond. Approximately 200 property owners responded by e-mail or mail and their input was combined with those who attended the meetings. To gather issues and rank them in order of importance for the property owners who attended the meetings, the nominal group process was used. Approximately 130 property owners attended the meetings. The following issues were identified and ranked as the most important: 1. improve water quality; 2. aquatic plant control; 3. eliminate algae blooms; 4. septic system regulation.

In May 2004, the Tri-Lakes Management District conducted a survey of public users of the lakes. The survey identified issues important to the users. The information was used to develop goals and action items for the Tri-Lakes Management Plan.

Limnological Analysis of Tri-Lakes, Wisconsin, 2002

In 2000, the U.S. Army Corps of Engineer-EauGalle Aquatic Ecology Laboratory, UW-Stevens Point and Department of Natural Resources conducted a study to determine what impacted the water quality of the Tri-Lakes. The study determined 55% of the total phosphorus load came from 14 Mile Creek Watershed while the remainder came from the shoreline area and from the lake bed. Fourteen Mile Creek provided 44% of the total phosphorus load from the

watershed, while Leola Ditch contributed 33% from the watershed and Unnamed Ditch 13-13 contributed 23%. Lower Lake Camelot retains 60% of the total phosphorus load received from the watershed. Tri-Lakes bottom sediments do not release large amounts of phosphorus. The study measured toxicity, which occurred at a greater frequency at stream and ditch locations and was associated with high flows. The Trophic State Index was used to determine the water quality of the Tri-Lakes is moderate to poor or mesotrophic to eutrophic. Phosphorus and "chlorophyll a" concentrations increased in downstream lakes due likely to phosphorus loading from groundwater or sediment release. The back bays have slightly poorer water quality than the lake main stems. Using a prediction model, it was estimated the Tri-Lakes water quality would improve if upper watershed external phosphorus loading were reduced 50%. Camelot would show most improvement while Sherwood and Arrowhead would be lower in magnitude due to groundwater or sediment phosphorus loading. The study recommended developing a lake management plan to improve water quality, inventory phosphorus sources and assess how they are reduced, and increase buffers between surface water and agricultural land.

The study conducted in 2000 to 2002 stated aquatic plants improve water quality, provide habitat and food for fish and wildlife, and resist invasion of non-native species. The study stated the plant communities are below average for Wisconsin Lakes and the plant community is dominated by disturbance tolerant species. The plant community can be improved by machine harvesting in a pattern that provides edges of vegetation, reduce chemical use for aquatic plant control, reduce winter draw downs and use them for noxious and invasive plant control only, and restore natural buffer zones of native vegetation along the shoreline.

A study of the groundwater conducted in 2000 to 2002 concluded a substantial source of groundwater phosphorus loading comes from decomposition of wetland soils buried during lake development. The study also concluded septic systems were contributing nitrates and chlorides and less significant amounts of phosphorus. The amounts of these nutrients added to the groundwater, increased during the draw down period. The study recommended reducing nutrient inputs to groundwater. The sources of nutrients are septic systems located in groundwater shoreline areas that flow to the lake, application of homeowner fertilizers in the shoreline area, and the use of phosphorus sources in the home. Forty-five percent of the nutrient loading is coming from the shoreline area and the lakebed.

Soil Retention of Phosphorus From Septic Systems, 1999

A study involving 5 septic system drainfields in the Arrowhead Lake area was conducted to measure the phosphorus concentrations in the subsoils beneath the drainfields. The results showed: the average total phosphorus concentrations below the drainfields were significantly higher than those collected in areas outside of the drainfield; at depths greater than 3 feet below the drainfield, elevated total phosphorus concentrations were found; and total concentrations of phosphorus varied significantly between sites aged between 10 to 30 years old. Conclusions of the study were: total phosphorus retention by soils under the drainfields is nonuniform due to differences in septic tank effluent discharge and/or reactivity of soils to phosphorus; on-site waste systems in compliance with code distance to groundwater still releases phosphorus to groundwater due to soils low ability to retain phosphorus; models estimate the phosphorus retention range of 6 feet of soil beneath a drainfield is 30% to 50% which confirms that

movement of phosphorus through the soil profile is occurring in septic drainfields in the Tri-Lakes area.

Lake Camelot and Lake Sherwood Septic System Evaluations, 1999

In 1997 and 1998, Camelot and Sherwood Lakes residents were asked to participate in a septic system evaluation survey. 174 out of 1,204 septic systems on Camelot and Sherwood Lakes were inspected. Nineteen of the systems were classified as failing and the average age of the failing systems was 24 to 27 years. Hydraulic failure can be identified by excessive ponding of a drainfield vent. Hydraulic failure occurs when effluent is prevented from discharging from the septic tank into the ground. Factors that cause hydraulic failure are time, excessive household water use, over-use of garbage disposals, putting harmful agents like bleach in septic tanks, and failure to remove septic tank solids at regular intervals. The consequence of hydraulic failure is wastewater is discharged to the ground surface, providing nutrients a pathway to surface waters. The septic systems in the Tri-Lakes are located in sandy soils. These soils allow water to move through the soil profile rapidly not providing much time for nutrient removal. Phosphorus is the nutrient of concern from septic effluent. Phosphorus contacts and attaches with iron and aluminum as it travels downward through the soil and becomes immobile. Over time, the soils ability to immobilize the phosphorus decreases allowing the phosphorus to pass into the ground water. It was estimated that 5% of the phosphorus loading to the Tri-Lakes comes from septic systems and this is projected to rise to 30% by the year 2039. It was concluded that alternative waste management practices and strategies could be considered. It was also concluded the sandy soils in the Tri-Lakes area do not provide much phosphorus removal before septic effluent reaches the groundwater and the lakes and as septic systems grow older and more residents become permanent, more phosphorus will reach the Tri-Lakes.

Tri-Lakes and Watershed Characterization, 1993

The objectives of this study were to study the flow of dam toe drains and to develop a lake management water quality plan. The study reported water flows throughout the watershed were monitored between 1964 and 1979 and an average watershed runoff was determined to be 6.3 inches or 42.3 cfs or 30,594.3 acre feet/ year.

The study reported phosphorus loading in the Tri-Lakes increased between 1978 and 1991. In North Camelot, the comparison shows an increase in phosphorus loading of 83 kilograms (kg) in 1978 to 256 kg in 1991, with notable sources of increase being: septic tanks – 0 kg in 1978 to 99 kg in 1991; and streams – 58 kg in 1978 to 126 kg in 1991. In South Camelot, the comparison shows an increase in phosphorus loading of 726 kg in 1978 to 1,227 kg in 1991, with notable sources of increase being: septic tanks – 0 kg in 1978 to 66 kg in 1991; and streams – 686 kg in 1978 to 1,119 kg in 1991. In Sherwood, the comparison shows an increase in phosphorus loading of 266 kg in 1978 to 953 kg in 1991, with notable sources of increase being: septic tanks – 0 kg in 1978 to 48 kg in 1991; and streams – 166 kg in 1978 to 864 kg in 1991. In Arrowhead, the comparison shows an increase in phosphorus loading of 1,079 kg in 1978 to 1,433 kg in 1991, with notable sources of increase being: septic tanks – 0 kg in 1978 to 100 kg in 1991; and streams –1,241 kg in 1978 to 1,433 kg in 1991. Lake phosphorus concentrations

show the Tri-Lakes are approaching threshold phosphorus concentration, which is where a lake passes from clear water and plants to turbid water and algae.

The study conducted in 1991 to 1992 recommended the following to maintain good water quality in the Tri-Lakes: implement best management practices to reduce soil erosion in the Tri-Lakes Watershed; continue to monitor water quality of incoming streams and lakes; educate residents in ways to prevent excessive nutrient inputs; conduct regular aquatic plant surveys to monitor the results of harvesting; continue to harvest aquatic plants and test the plant tissue to determine how much phosphorus has been removed; develop test plots to demonstrate various aquatic plant control methods; create natural landscaping along the shorelines; and conduct a septic leachate survey of the Tri-Lakes shoreline area.

Water Management Plan 14 Mile Creek Watershed, 1979

Numerous individuals from local, state, and federal governments, private industry, and the public cooperated to investigate the natural resources to develop a water management plan for the 14 Mile Creek Watershed. The plan referenced the following statements: In aquatic systems, aquatic plants play an important role providing food, shelter, and oxygen to aquatic organisms (Biology of Aquatic Vascular Plants, 1967); Aquatic plants act as a nutrient sink for aquatic ecosystems by accumulating large quantities of inorganic nutrients in the growing season, thus making nutrients unavailable for algae growth (The Limnological Role of Aquatic Macrophytes and Their Relationship to Reservoir Management, 1971); Aquatic plants provide spawning and foraging areas for fish common to northern temperate lakes. The optimum proportion of plant area to water area for fish production is unknown (Northern Fishes, 1974).

Analysis of 1978 lake water quality data indicated the Tri-Lakes were in a mesotrophic to eutrophic status. To improve the status of the lakes, it was recommended to install measures to reduce inlake phosphorus concentrations. The data suggested the most significant source of phosphorus and nitrogen was in the stream flow from upper 14 Mile Creek Watershed. Due to high flushing rates and high nutrient concentrations in the lakes, practices to reduce phosphorus concentrations in the lakes are too costly. Recommendations also suggested septic tanks should be inspected periodically to determine the need for pumping to prevent the release of sludge and scum. The sludge and scum degrades the performance of the septic system. Recommendations also stated the need for a central sewage system was not needed at this time. However, when the community becomes fully developed and groundwater monitoring shows pollution from onsite waste disposal systems, wastes should be treated by a central sewage system. Recommendations also stated shoreline erosion and storm water runoff need to be managed. Alum treatments to control algae are not recommended due to the Tri-Lakes having a non-stable summer thermocline with a short residence time for the water and high external nutrient loading. Selective discharge is not recommended due to the Tri-Lakes not forming stable thermoclines. Bottom sealing and dredging are not recommended due to high expense and the sediments of Camelot and Sherwood do not release enough substantial nutrient loading to the lake. Dewatering of sediments will not be effective because of the sandy substrates and over-winter lake drawdowns may not allow for complete refilling of the lakes. Dilution and flushing require high capacity wells containing low nutrients. There is not enough data at this time to determine

if this is a viable option. Aeration is not required in the Tri-Lakes at this time. Dissolved oxygen levels are not critically low at any time of the year and bottom sediments are not anoxic.

The water management plan stated that historically, aquatic plant growth was found at the east ends of Sherwood and Camelot Lakes due to shallow waters and ports of entry for nutrients. Water depths in these areas allow light penetration to the lakebed therefore, encouraging plant growth. Maximum depth of aquatic plant growth was determined to be 7 feet for Southern Camelot, Arrowhead and Sherwood, and 9 to 10 feet for Northern Camelot. Aquatic plant growth will occur in narrow bands along the shorelines and inlet areas. Sedimentation will increase the areas available for aquatic plant growth. Acres of water treated with chemicals to control algae and aquatic plants on Camelot and Sherwood Lakes has increased 83% from 1970 to 1977. Chemical treatment of aquatic plants produces a competitive advantage for algal growths because the plants are not there to uptake nutrients. Records indicate chemical treatment for planktonic algae occurred two to four weeks following chemical treatment for aquatic plant control. This is explained by the release of phosphorus from the decomposing plants killed during chemical treatment, which the alga uses for growth. Decaying chemically treated plants in Sherwood Lake provided 25% of the total phosporus loading, while in Camelot Lake, decaying plants provided 39% of the total phosporus loading. Raking was utilized by the Lake Camelot Property Owners Association to control Aquatic Plant Growth during the summer of 1978. Two persons, working 20 hours per week raked beach club beaches. This method proved to be futile due to low harvesting efficiency and rapid plant regrowth. Mechanical harvesting has advantages such as: in contrast to chemical treatments, there is no waiting period to use the lake; decomposing aquatic plants are removed from the lake; it is site specific. Disadvantages of mechanical harvesting include: high initial investment; shallow areas cannot be harvested; aquatic plant community will be altered due to species with rapid regrowth will dominate; cuttings that escape collection may propagate vegetatively throughout the lake. Generally, overwinter drawdowns will control some aquatic plants while other plants will benefit and become the dominant species. The shallow eastern ends of Sherwood and Camelot Lakes have the greatest aquatic plant growth with species that benefit or are not affected by overwinter drawdowns. Therefore, winter drawdowns will not solve aquatic plant problems in Sherwood and Camelot Lakes. Substrate management is not recommended for Camelot and Sherwood Lakes due to low predicted success and high costs. Dredging is recommended only when shoreline erosion and slumping of the lake bottom create shallow water areas.

In 1979, the Water Management Plan for 14 Mile Creek Watershed reported stocking of game and pan fish in Camelot and Sherwood Lakes beginning in 1968 and continued to 1972, while walleye were stocked on an alternate year basis from 1972 to 1979. The plan also stated no northern pike reproduction was observed while there was only slight walleye reproduction noticed. Optimum type of habitat for walleyes, shallow washed gravel bars, is severely limited in Camelot and Sherwood Lakes. Northern pike spawning habitat is severely limited in both lakes due to lake drawdown during the spawning period, early April and the lack of dense beds of emergent aquatic plants.

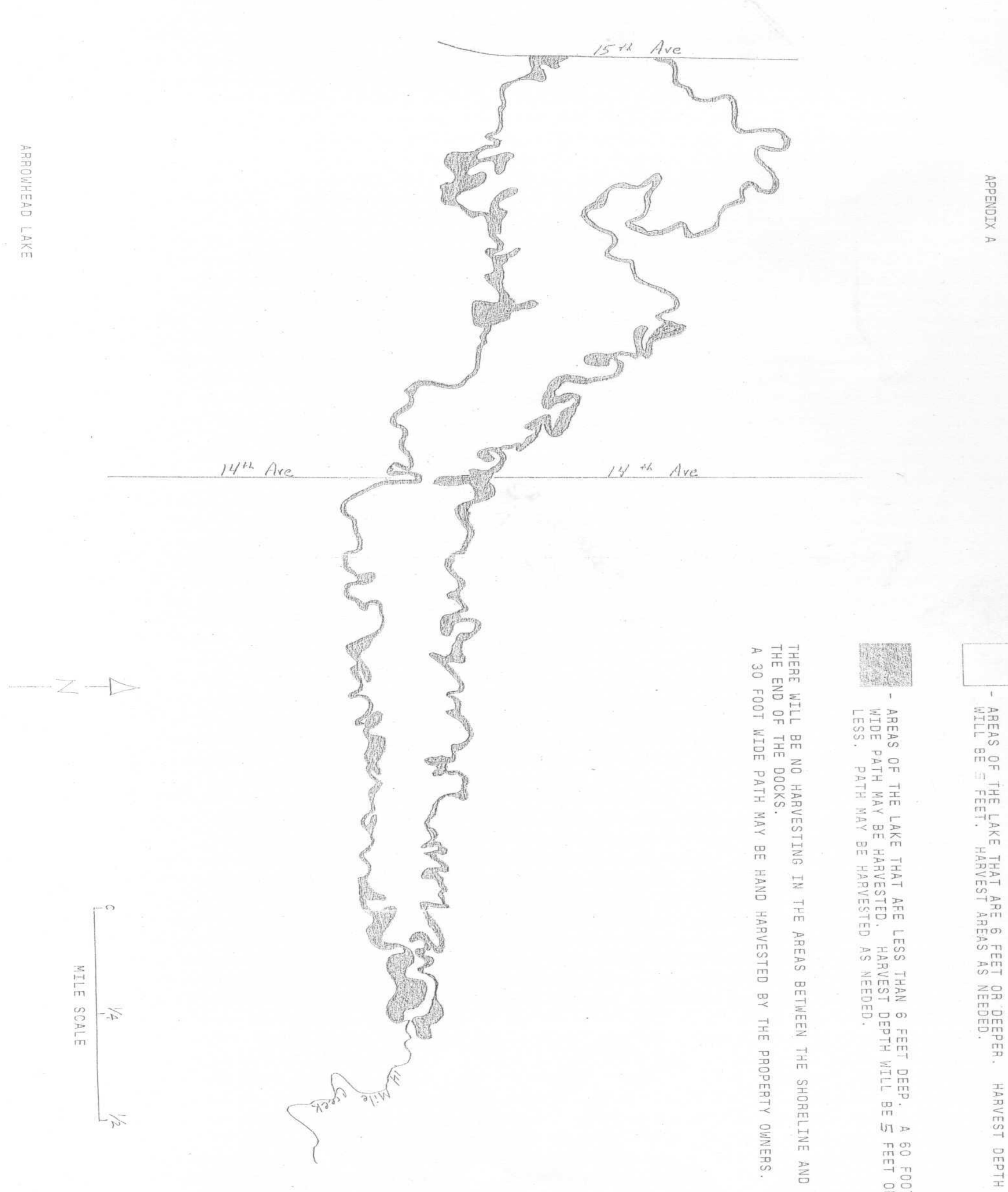
Stable populations of bass and pan fish were reported with the first observation of bass reproduction in 1972. Stunting of pan fish was suggested in 1977. (Zimmerman, 1978, personal communication) Stunting is a decline in the average size of pan fish harvested and a

decrease in the total abundance of game fish because of competition between young game fish and the pan fish (Disturbance of Predator-Prey Balance as a Management Technique, 1958). The Water Management Plan for 14 Mile Creek Watershed in 1979, reported the most common reason for stunting is a combination of excess aquatic plants providing refuge for small pan fish and lack of predators for balancing the pan fish populations. In 1979, the plan reported fish populations are adequate for a quality bass and walleye fishery, while a balanced pan fish population is the bulk of the fish caught.

A 1978 inventory of Sherwood and Camelot Lakes showed erosion from wave action on steep, vertical banks to areas of low relief. All arms of both lakes are subject to shoreline erosion due to wave action against predominately steep, sandy soil banks. Inlets and channels show less erosion. It was determined boats generate larger waves at low frequency while the wind generated smaller waves at a high frequency. The relationship of wave characteristics could not be defined therefore it was concluded that both wave types play a comparable role in shoreline erosion. Ice flows against the shoreline do not cause much erosion on Sherwood and Camelot Lakes due to the winter drawdown. Recommendations to reduce shoreline erosion include: encourage vegetation growth on shoreline and aquatic plant growth off shore; regulate boat speeds close to shore; and “no wake” rules in critical erosion areas.

The plan reported research conducted in 1978 concluded the groundwater flow in and out of Sherwood and Camelot Lakes was similar throughout the year. Sherwood Lake had greater inflows and Camelot Lakes had greater outflows during the winter drawdown period. During low surface flows, 1978 research indicated Lake Camelot may be well below normal during late summer and early winter, while Sherwood and Arrowhead Lakes would have normal levels. The annual average downstream release during low flows is 31 cubic feet per second (cfs) and during an average year the average downstream release is 52 cfs. It was determined that pumping groundwater into the lakes to supplement flows was not economically feasible.

APPENDIX A


APPENDIX A
ARROWHEAD LAKE
15th Ave
14th Ave
14th Ave
14 Mile Creek
- AREAS OF THE LAKE THAT ARE 6 FEET OR DEEPER. HARVEST DEPTH WILL BE 5 FEET. HARVEST AREAS AS NEEDED.
- AREAS OF THE LAKE THAT ARE LESS THAN 6 FEET DEEP. A 60 FOOT WIDE PATH MAY BE HARVESTED. HARVEST DEPTH WILL BE 5 FEET OR LESS. PATH MAY BE HARVESTED AS NEEDED.
THERE WILL BE NO HARVESTING IN THE AREAS BETWEEN THE SHORELINE AND THE END OF THE DOCKS.
A 30 FOOT WIDE PATH MAY BE HAND HARVESTED BY THE PROPERTY OWNERS.
N
0
1/4
1/2
MILE SCALE

APPENDIX B


APPENDIX B
LOWER CAMELOT LAKE
SCALE
◇ Access
◇ Access with Parking
◆ Boat Livery
N
- AREAS OF THE LAKE THAT ARE 6 FEET OR DEEPER. HARVEST DEPTH WILL BE 5 FEET. HARVEST AREAS AS NEEDED.
- AREAS OF THE LAKE THAT ARE LESS THAN 6 FEET DEEP. A 60 FOOT WIDE PATH MAY BE HARVESTED. HARVESTED DEPTH WILL BE 5 FEET OR LESS. PATH MAY BE HARVESTED AS NEEDED.
THERE WILL BE NO HARVESTING IN THE AREA BETWEEN THE SHORELINE AND THE END OF THE DOCKS. A 30 FOOT WIDE PATH MAY BE HAND HARVESTED BY PROPERTY OWNERS

APPENDIX C


APPENDIX C
UPPER CAMELOT LAKE
N
- AREAS OF THE LAKE THAT ARE 6 FEET OR DEEPER. HARVEST DEPTH WILL BE 5 FEET. HARVEST AREAS AS NEEDED.
- AREAS OF THE LAKE THAT ARE LESS 6 FEET DEEP. A 60 FOOT WIDE PATH MAY BE HARVESTED TO A DEPTH OF 5 FEET. HARVEST AS NEEDED.
- CONSERVANCY AREA. 60 FOOT WIDE PATHS CUT IN CRISS-CROSS FASHION HARVEST DEPTH WILL BE 5 FEET OR LESS
THERE WILL BE NO HARVESTING IN AREA BETWEEN THE SHORELINE AND THE END OF THE DOCKS
A 30 FOOT WIDE PATH MAY BE HAND HARVESTED BY THE PROPERTY OWNERS.

APPENDIX D


APPENDIX C
UPPER CAMELOT LAKE
N
- AREAS OF THE LAKE THAT ARE 6 FEET OR DEEPER. HARVEST DEPTH WILL BE 5 FEET. HARVEST AREAS AS NEEDED.
- AREAS OF THE LAKE THAT ARE LESS 6 FEET DEEP. A 60 FOOT WIDE PATH MAY BE HARVESTED TO A DEPTH OF 5 FEET. HARVEST AS NEEDED.
- CONSERVANCY AREA. 60 FOOT WIDE PATHS CUT IN CRISS-CROSS FASHION HARVEST DEPTH WILL BE 5 FEET OR LESS
THERE WILL BE NO HARVESTING IN AREA BETWEEN THE SHORELINE AND THE END OF THE DOCKS
A 30 FOOT WIDE PATH MAY BE HAND HARVESTED BY THE PROPERTY OWNERS.

LANDUSE IN 14-MILE CREEK WATERSHED

APPENDIX E

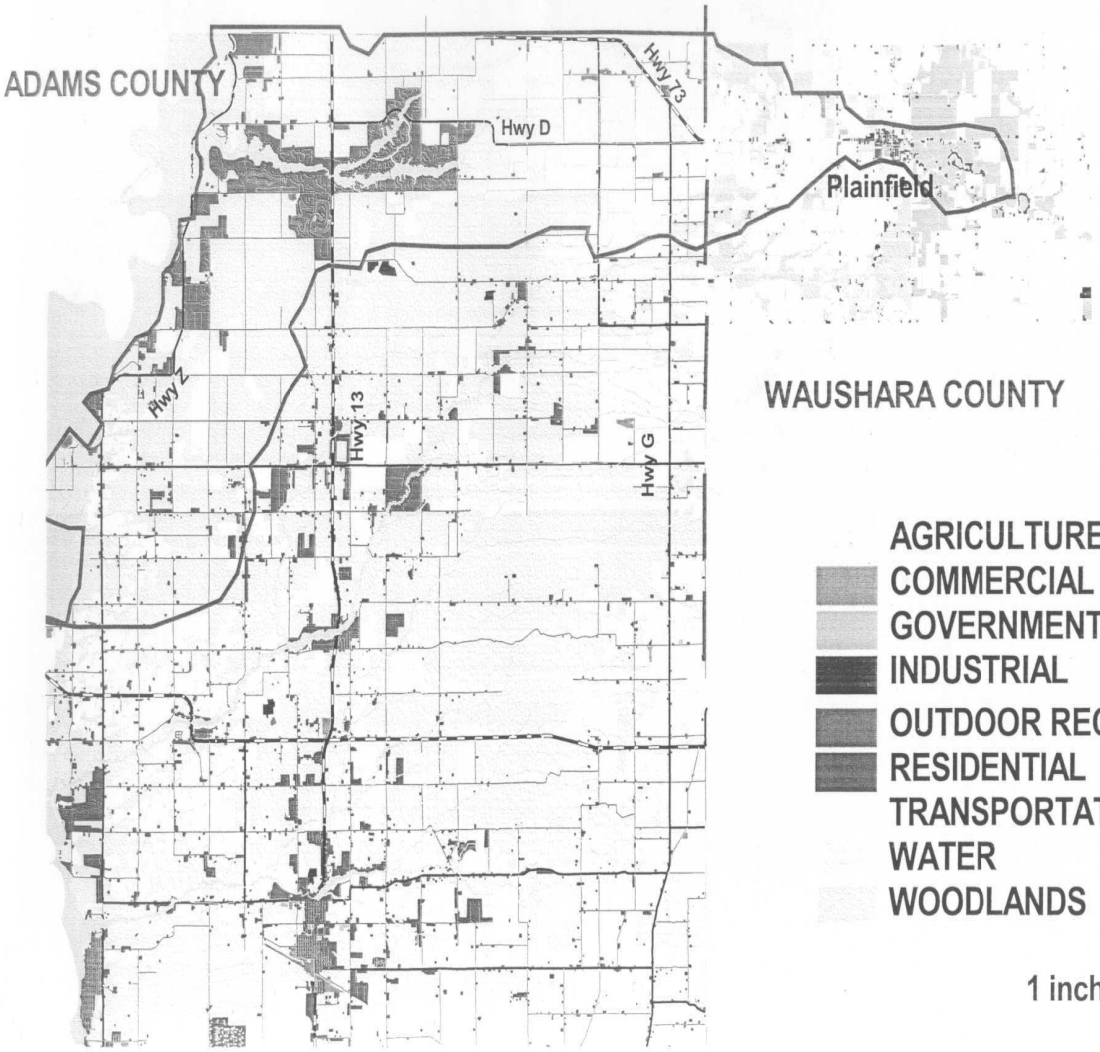


Table 2. Estimates of Carlson and Wisconsin Trophic State Index (TSI) values for stations in main-stem regions of the Tri-Lakes syystem. Concentrations of chlorophyll *a* and total phosphorus (TP) and Secchi transparency represent means (CV) over the upper 4 m water column for the period May through September.

				Carlson TSI			WI TSI		
Lake	Secchi, m	Chla, µg/L	TP, µg/L	TSI_{SD}	TSI_{chla}	TSI_{TP}	$WTSI_{SD}$	$WTSI_{chla}$	$WTSI_{TP}$
Camelot	2.1 (0.05)	9.5 (0.14)	11 (0.13)	49	52	39	49	52	47
Sherwood	2.2 (0.16)	14.8 (0.19)	15 (0.15)	49	57	43	49	55	49
Arrowhead	1.5 (0.09)	21.9 (0.16)	24 (0.16)	54	60	54	54	58	53

Trophic State Index Ranges

Oligotrophic = <30, Mesotrophic = 40 – 50, Eutrophic = 50 – 70

APPENDIX G

TRI-LAKES CRITICAL WATER ELEVATIONS
IN FEET ABOVE SEA LEVEL
LAKE CAMELOT

Maximum Lake Level Elevation ……..1013.00
Normal Summer Lake Level Elevation ……1012.00
Minimum Summer Lake Level Elevation ……1011.90
Minimum Winter Lake Level Elevation ……..1011.40
Assumed Dam Failure Elevation ……1014.91
100 Year Flood Elevation ……1014.91
Top of Dam Elevation ……..1018.00
* Summer : April 15 – October 15, Winter : October 15 – April 15

LAKE SHERWOOD

Maximum Lake Level Elevation …… 993.70
Normal Summer Lake Level Elevation …… 992.80
Minimum Summer Lake Level Elevation …… 992.70
Minimum Winter Lake Level Elevation ……... 992.20
Elevation of Sherwood if Camelot would fail during 100 year flood ….. 999.03
100 Year Flood Elevation ……. 995.51
Top of Dam Elevation ……..1000.00
* Summer : April 15 – October 15, Winter : October 15 – April 15
Highway 13 elevation …….. 980.60
Dam Failure Elevation at Highway 13 …… 988.82

LAKE ARROWHEAD

Maximum lake Level Elevation …….. 964.25
Normal Summer lake Level Elevation …… 964.00
Minimum Summer Lake Level Elevation …….. 963.70
Minimum Winter Lake Level Elevation ……. 963.70
Elevation of Arrowhead if Sherwood would fail during 100 year flood. 972.96
100 Year Flood Elevation …….. 967.01
Top of Dam Elevation …… 971.30
* Summer : April 15 – October 15; Winter : October 15 – April 15

Highway Z Elevation ……. 931.22
100 Year Flood Elevation of Highway Z …….. 932.47
Dam Failure Elevation at Highway Z …… 933.63

APPENDIX I

TRI-LAKES ADVISORY GROUP CONSIDERS PUBLIC COMMENTS

The Tri-Lakes Advisory Group (TLAG), composed of various interested persons and agencies, is in the process of developing a Tri-Lakes Management Plan. The group has held several meetings earlier this year, facilitated by the Adams County Land & Water Conservation Department, and drafted a proposed plan. Two meetings for public input concerning the proposed plan were held on 6/7/04 and 6/12/04. All public comments were discussed at a 7/1/04 meeting of the TLAG. Several were incorporated into the plan, which is currently being finalized. The majority of the public meeting comments focused on (1) water quality; (2) weed and algal growth; and (3) winter drawdowns of Lakes Camelot & Sherwood.

Several opinions and questions were expressed about water quality. Some thought water quality had not decreased, so no need for a current plan. Some felt that Camelot Lake was serving as a "nutrient sink" from the upper watershed, while other thought that Arrowhead Lake had the worst water quality because it had no drawdowns. Other comments expressed concern about whether agricultural producers in the upper watershed were contributing to nutrient-loading and water quality degradation. Others had questions about shoreline area practices and their potential contributions to decreased water quality. Concerns were expressed about possible septic system seepage as a factor in decreased water quality and flows from drainage ditches and the flow of water into the Tri-Lakes from the upper watershed.

In addition to reviewing the public comments, discussion at the 7/1/04 meeting centered on a recent study that suggested that overall water quality is similar to what it was in the past, although certain areas of concern, such as phosphorus content & movement, aging septic systems, land use practices, and reduced aquatic habitat, indicate that unless a management plan addressing such issues is put into effect, water quality will decline drastically as the system reaches its limit. Further, since use of the lakes and construction around the lakes has increased considerably in the last 20 years, the potential for quicker decrease in water quality is greater because the amount and numbers contributing is greater. Comments from many citizens, as well as from many members of the TLAG, indicated that weed growth and algal blooms were a point of great concern. Public comments generated much discussion on addressing these issues. Scientific information provided to TLAG members showed that weed and algal growth are directly impacted by water quality (both surface and ground water).

Based on public input, the TLAG incorporated the following into the management plan:

- Samples will be taken near the dams to evaluate groundwater flow and phosphorus movement and origin around the dams;
- New technology for private waste systems (including septics) will be investigated and a plan developed to incorporate it into local/state regulations to improve sanitary systems, including both new and old systems;
- Education efforts will be made to inform lakeshore residents and public users about activities that negatively impact water quality, including the availability of cost-share funds and possible grants for seawall replacement, buffer protection, shore protection alternatives to rock riprap, etc., and about actions they can take to improve the situation.
- Remove nutrients from the lake through unlimited removal of plants at depths greater than 6';
- Provide healthy shallow-water habitat and reproduction areas for aquatic life, including fish;
- Eliminate the current winter drawdowns of Lakes Camelot & Sherwood in 2006, since the drawdowns serve to draw more nutrients into the lakes by changing the groundwater flow from away from the lakes to going into the lakes;
- Eliminate the current winter drawdowns because they destroy shallow water habitat for aquatic life, unless further scientific studies establish that drawdowns are beneficial for nutrient reduction and aquatic life;
- Stop using chemicals for aquatic plant control, since it appears that algal blooms increase after use of chemicals.

Also considered during examining the public comments and incorporation into the Management Plan were the financial costs of these actions and the need for education on many of these issues for lake residents and lake users. TWAG decided a cost analysis will be conducted in 2005 to determine costs to property owners due to drawdown eliminations. TWAG also decided that the plan should contain financial assistance options to landowners affect by drawdown elimination. TWAG anticipates that once the final draft is completed, meetings and workshops will be held over the next few years to help inform lake owners and lake users about the plan, its potential costs, and actions the public can take to assist in success of the plan.

APPENDIX J

TABLE OF ACCOMPLISHMENTS

YEAR	ACTION ITEMS	WHO
Annual	Harvest lakes 6 foot deep or greater as needed to a depth of 5 feet. Areas shallower than 6 feet can have a harvested path of 60 feet wide with a harvest depth 4 feet or less	Tri-Lakes Mgmt District
Annual	Conservancy areas will be marked on the harvest maps. Sixty foot wide paths will be harvested in a criss-cross pattern. Harvesting depth shall be 4 feet or less	Tri-Lakes Mgmt District
Annual	WDNR representative and a Tri-Lakes Management representative annually inspect harvesting operations	WDNR and Tri-Lakes Mgmt District
Annual	Record the pounds of aquatic plants removed and report to WDNR	Tri-Lakes Mgmt District
Annual	Measure the phosphorus content of harvested aquatic plants	Tri-Lakes Mgmt District UWSP
Annual	Deny aquatic plant spraying permits for shoreline aquatic plant control	WDNR
Annual	Educate individuals on alternative control methods for aquatic plants	Tri-Lakes Mgmt District
Annual	Conduct annual inspections of dams and record findings	Adams LWCD
Annual	Operate, inspect & repair dams to meet Chapter 31 and NR chapter 330 operation done in proactive manner to prevent large water releases	Adams LWCD
Annual	Review and update the Emergency Action Plan	Adams LWCD
Annual	Maintain water level gauges on dam	Adams LWCD
Annual	Designate areas for boating/skiing as part of the harvest plan	Tri-Lakes Mgmt District
Annual	Regulate lake traffic to increase lake safety	Town of Rome
Annual	Implement NR151 Ag Performance standards in lake's watershed	Adams LWCD
2005	Formed Sanitary District to regulate pre-1992 septic systems	Tri-Lakes Mgmt District
2005	Inventoried shorelines to map erosion, no buffers & no storm water management	Adams LWCD
2006	Performed Aquatic Plant Survey and published findings along with Management Recommendations.	Adams LWCD WDNR